

NON-PUBLIC?: N  
ACCESSION #: 9411290096  
LICENSEE EVENT REPORT (LER)

FACILITY NAME: River Bend Station PAGE: 01 OF 04

DOCKET NUMBER: 05000458

TITLE: MANUAL REACTOR SCRAM DUE TO HIGH LP TURBINE VIBRATION  
CAUSED BY TEMPERATURE SENSITIVE ROTOR  
EVENT DATE: 10/28/94 LER #: 94-028-00 REPORT DATE: 11/18/94

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 040

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR  
SECTION:  
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:  
NAME: T.W. Gates, Supervisor - Nuclear TELEPHONE: (504) 381-4866  
Licensing

COMPONENT FAILURE DESCRIPTION:  
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:  
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

#### ABSTRACT:

On October 28, 1994, with the plant in Operational Condition 1 (Power Operation) and decreasing power for a planned shutdown, vibration levels on main turbine bearings 5 and 6 increased to the trip set point of 10 mils. The plant was manually scrammed and the turbine manually tripped to prevent potential turbine damage due to high vibration.

The root cause of the event is increased temperature sensitivity of the Low Pressure Turbine Rotor B following its recent replacement in conjunction with step changes in rotor temperature caused by throttling the reheating steam supply valves. Corrective actions include limiting the rate of rotor temperature change by expanding the limitations at which the MSRs can be placed into or removed from service during plant start-up or shutdown. During the event, turbine vibration remained within acceptable levels and the temperature change requirements for the MSR

were never exceeded. An evaluation determined that safety systems functioned as designed and concluded the event was of no safety significance.

END OF ABSTRACT

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#### REPORTED CONDITION

On October 28, 1994, with the plant in Operational Condition 1 (Power Operation) and decreasing power for a planned shutdown to allow for replacement of reactor recirculation pump seals, vibration levels on main turbine (\*TRB\*) bearings 5 and 6 increased to 10 mils. The plant was manually scrammed and the turbine manually tripped to prevent potential turbine damage due to high vibration. This report is submitted pursuant to 10CFR50.73 (a)(2)(iv).

#### INVESTIGATION

On October 28, 1994, with the plant at approximately 40% generator power and decreasing for a planned shutdown, the operators were preparing to transfer the reactor recirculation pumps to slow speed. During this time, vibration indications for low pressure (LP) turbine bearings 5 and 6 began increasing. The vibration increased from approximately 6 mils to the trip setpoint of 10 mils over a period of approximately 6 to 8 minutes. The high vibration turbine trip is normally bypassed during normal turbine generator service; therefore, to prevent turbine damage, the reactor was manually scrammed at approximately 2338 and the turbine was manually tripped approximately 1.5 minutes later. As the main turbine coasted down subsequent to the trip, the maximum vibration occurring on bearings 5 and 6 was 13.5 mils and 12.4 mils respectively. These maximums occurred as rotational speed passed through the turbine's critical speeds.

During previous outages, Refueling Outage 5 (RF-5) and Forced Outage 94-01 (FO 94-01), various modifications were performed on the LP turbines. During RF-5, both LP rotors were replaced. During start-up from RF-5, higher than normal vibration (about 6.2 mils) was noted on the 5 and 6 LP turbine bearings. As a result, balance weights were installed during FO 94-01 to reduce bearing vibration. This modification resulted in bearing vibrations (bearing 5 and 6) being reduced to about 4.9 mils. As a result of these modifications, the performance of the LP turbine rotors was improved.

The only plant evolution in progress preceding the event was the

continuing decrease in plant power. During this evolution and several minutes prior to the increase in vibration, the Moisture Separator Reheater (MSR) (\*MSR\*) reheating steam supply MOVs (1MSS-MOV111 and 1MSS-MOV112) had been throttled to continue removal of the MSRs from service.

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Operating requirements prior to this event required the MSR tube side heating steam to be taken out of service from about 65% to 35% generator power. This operation was normally accomplished by throttling the reheating steam supply valves, 1MSS-MOV111 (\*ISV\*) and 1MSS-MOV112 (\*ISV\*). These are 10" motor-operated gate valves which are intended to isolate the reheating steam supply to the MSRs after the MSRs have been automatically taken out of service with the high load/low load valves, 1MSS-PVRSHLV1/2 (\*FCV\*) and 1MSS-PVRSLLV1/2 (\*FCV\*). However, due to reliability concerns associated with the use of high load/low load valves to control MSR reheating steam, 1MSS-MOV111 and 1MSS-MOV112 are normally used to remove the MSRs from service. Since 1MSS-MOV111 and 1MSS-MOV112 are gate valves, MSR tube side and shell side temperatures are lowered in a series of incremental step changes, as opposed to a ramp change which would result by using of the high load/low load valves to control flow.

The GE main turbine manual states that "Occasionally a rotor is found to be sensitive to temperature changes, which seem to cause significant bowing and resultant temporary unbalance. If this unusual thermal sensitivity is found, it might be necessary to develop a compromise balance which will produce acceptable vibration levels over the whole operating range." This temperature sensitivity is related to the clearances between rotating and stationary portions of the new LP rotors which are tighter with a new rotor. The temperature step changes resulting from use of 1MSS-MOV111 and 1MSS-MOV112 to control reheating steam flow within MSR service limitations was acceptable for operation utilizing the turbine rotor which was installed until RF-5. However, the incremental step changes associated with the use of these valves were apparently not compatible with the increased temperature sensitivity of the new turbine rotor installed during RF-5.

A review was performed of River Bend Station plant history and no other similar occurrences were identified.

#### ROOT CAUSE

The root cause of the event (increase in turbine vibration while decreasing plant power) is the increased temperature sensitivity of the

LP turbine rotor B in conjunction with step changes in rotor temperature. This temperature sensitivity is related to the clearances between rotating and stationary portions of the new LP rotor which are tighter than for the previous rotor. The step changes in rotor temperature are a result of throttling the reheating steam supply valves, 1MSS-MOV111 and 1MSS-MOV112, in incremental steps while placing the MSRs on line or removing them from service.

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#### CORRECTIVE ACTION

Expanding the limitations at which the MSRs can be placed into or removed from service will allow for a decrease in the magnitude of the individual temperature step changes during plant startup and shutdown. These service limitations were expanded by revising procedures GOP-0001, "Plant Startup; " GOP-0002, "Power Decrease / Plant Shutdown- " and SOP-0010, "MSR and FW Heaters Extraction Steam and Drains;" to begin taking the MSRs out of service at 90% generator power and be removed from service by 15% generator power on decreasing power and to begin placing the MSRs into service at 15% generator power and be in full service by 90% generator power on increasing power. The lower power limit is based on turbine, plant, and steam drain flow rates and meets the design intent of the reheating control system. The upper limit is based on main turbine control valve position restrictions. These changes will more closely match the design intent of the reheating steam control system (well controlled ramp rate) and will decrease the magnitude of temperature step changes that occur when placing MSRs in or out of service during plant startups and shutdowns.

#### SAFETY ASSESSMENT

An evaluation was performed which determined that all safety systems functioned as designed and concluded that this event was of no safety significance. Turbine vibration remained within acceptable levels and the temperature change requirements for the MSR were never exceeded.

Note: Energy Industry Identification Codes are indicated in the text as (\*XX\*).

ATTACHMENT TO 9411290096 PAGE 1 OF 2

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JAMES J. FISICARO  
Director  
Nuclear Safety

November 18, 1994

U. S. Nuclear Regulatory Commission  
Document Control Desk  
Mail Stop P1-37  
Washington, D.C. 20555

SUBJECT: River Bend Station - Unit 1  
Docket No. 50-458  
License No. NPF-47  
Licensee Event Report 50-458/94-028-00  
File Nos. G9.5, G9.25.1.3

RBG-41067  
RBF1-94-0114

Gentlemen:

In accordance with 10CFR50.73, enclosed is the subject report.

Sincerely,

JJF/kvm  
Enclosure

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RBF1-94-0114  
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